

Wave and Tidal Energy: What's happening?

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EPRI Ocean Energy Feasibility Assessments

■ Motivation

- Offshore wave and tidal in-stream energy resources are too important to overlook

■ Objective

- Demonstrate feasibility of offshore wave and tidal in-stream power generation in North America
- Accelerate sustainable commercialization of the technology

■ Approach

- Facilitate public/private collaborative partnership between coastal states, involving state agencies, utilities, device developers, interested third-parties, and the DOE

EPRI Project Participants

State/City Agencies (10)

Maine Tech Initiative
Mass Tech Collaborative
New Brunswick Ministry
Nova Scotia Ministry
Alaska Energy Authority
Washington CTED
Oregon DOE
San Francisco, Marin
County, Oakland CA

Federal (2)

U.S. DOE
NREL

Technology Companies (30)

Wave & Tidal Power

Utilities (17)

Bangor HydroCentral
Maine Power
National Grid
NSTAR
NB Power
NS Power
Chugach
Tacoma Power
Seattle City and Light
Snohomish PUD
Bonneville Power
Central Lincoln PUD
Douglas County PUD
Portland General
PacifiCorp
PG&E
HECO

Universities (3)

Virginia Tech
Oregon State Univ.
Univ. of Washington

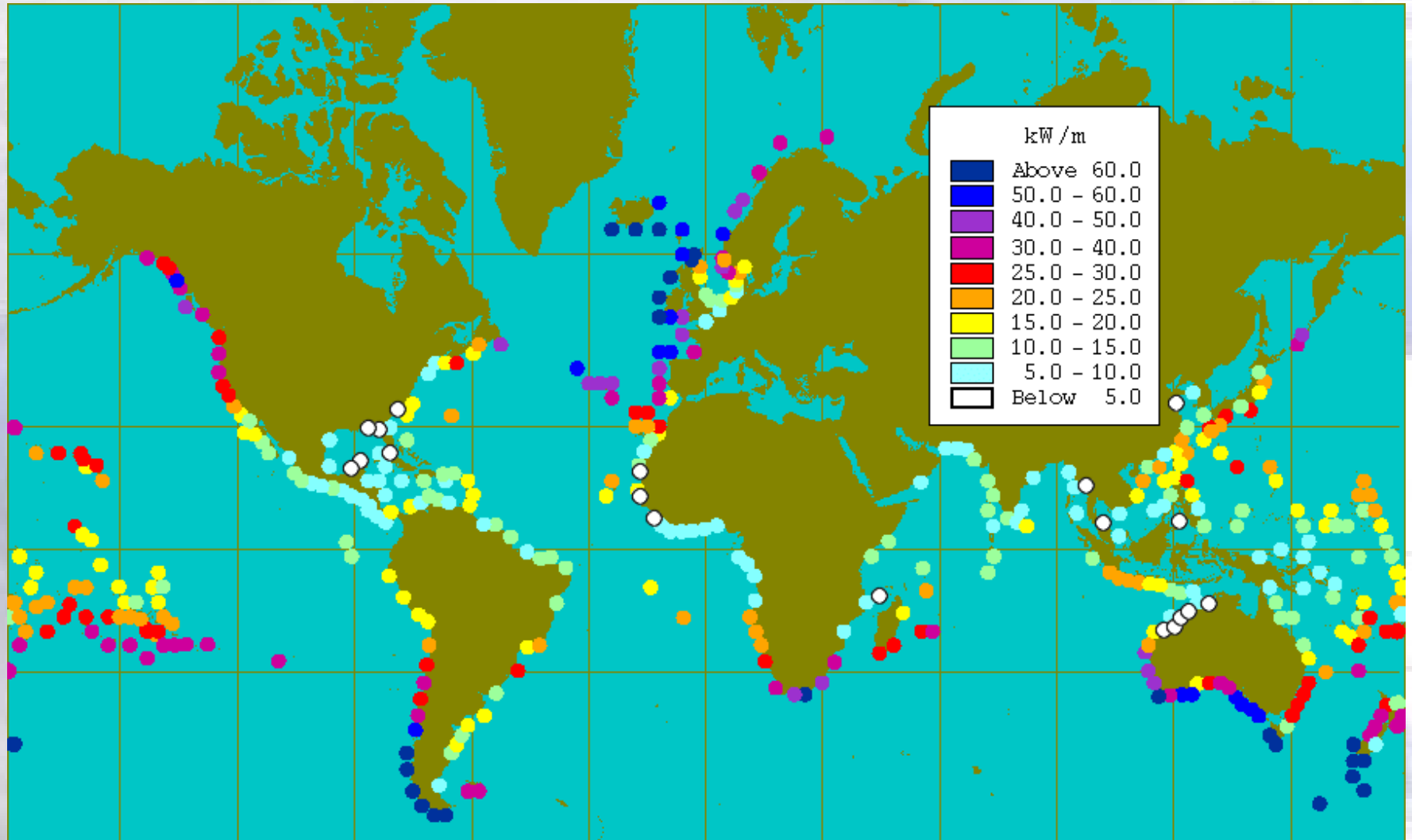


EPRI PROJECT

Resource Comparison

	Solar PV	Wind	Wave	Tidal Current
Development Status	Early Commercial	Commercial	Pre-Commercial	Pre-Commercial
Source	Sun	Uneven solar heating	Wind blowing over water	Gravity of moon & sun
Annual Average Power Density	200-300 watts/m ² (southern & western US)	400-600 watts/m ² (US Great Plains)	20-25 kW/m (US West Coast) 5-15 kW/m (US East Coast)	5-10 kW/m ² (Alaska, Bay of Fundy) 1-2 kW/m ² (Seattle, SF)
Intermittency	Day-night; clouds, haze, and humidity	Atmospheric fronts and storms (local winds only)	Sea (local winds) <u>and</u> <u>swell</u> (from distant storms)	Diurnal and semi-diurnal (advancing ~50 min./day)
Predictability	Minutes	Hours	Days	Centuries

Global Wave Energy Resource Distribution



Typical Wave Energy Conversion Devices

**OPT PowerBuoy & AquaEnergy AquaBuoy
(Point Absorbers)**



Pelamis (Attenuator)



**Energetech Oscillating Water
Column (Terminator)**



Wave Dragon (Overtopping)

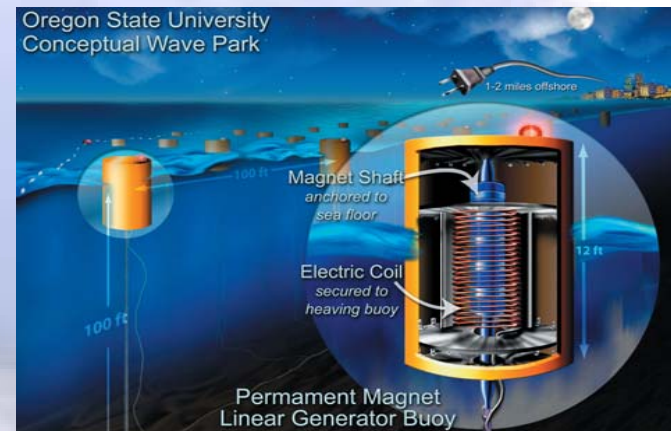


Other Wave Point Absorbers

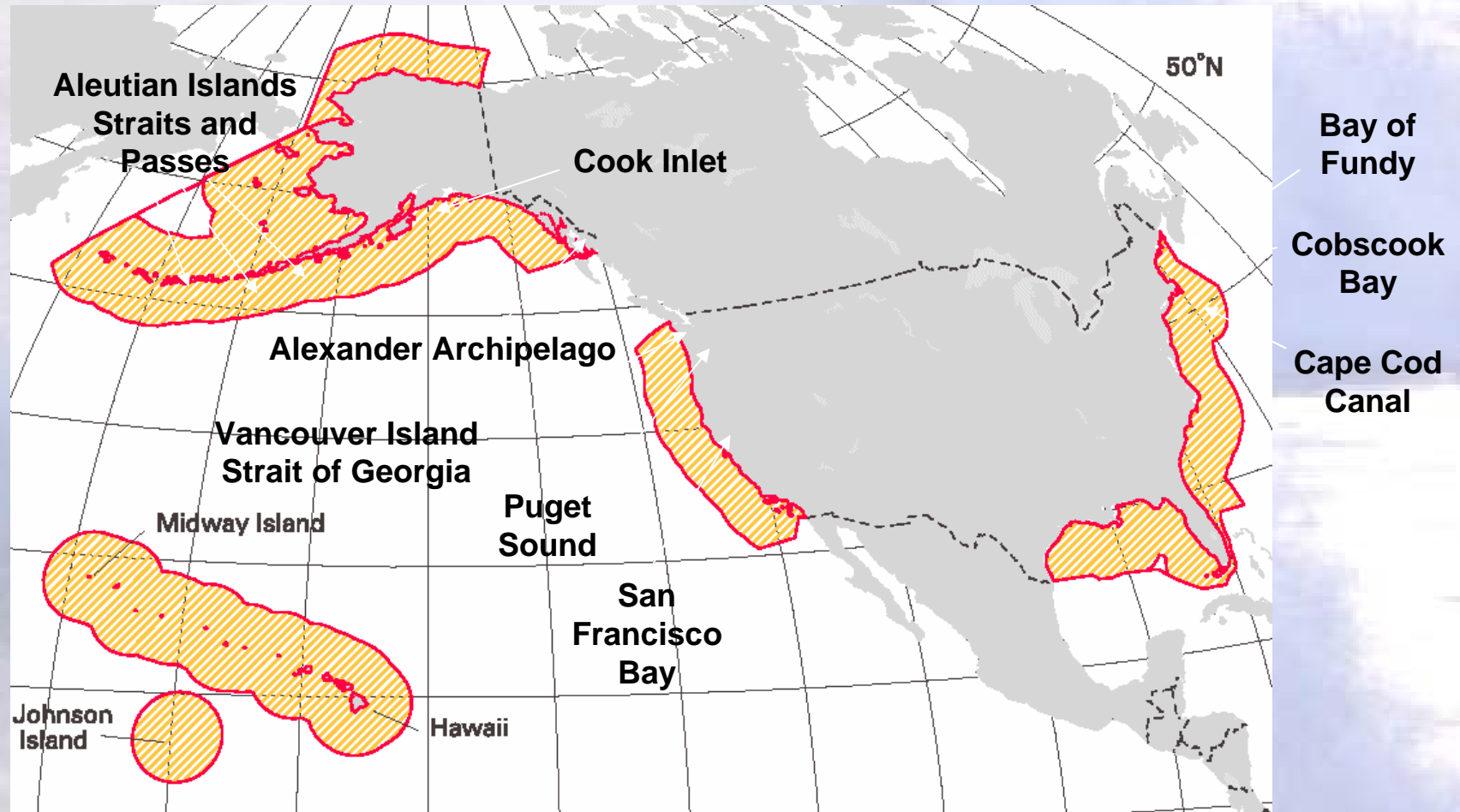
**Archimedes Wave Swing
Linear Generator**



**OSU Linear Generator
and Future Vision**



North American Tidal Current Sites



North America In Stream Tidal Demonstrations

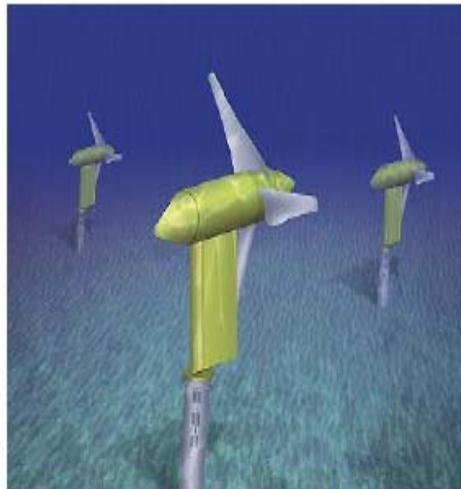
East River, New York, NY



Amesbury, Merrimack River MA



Verdant Horizontal Axial Turbine



GCK Gorlov



Other NA In Stream Tidal Demonstrations

UEK – Chesapeake Bay

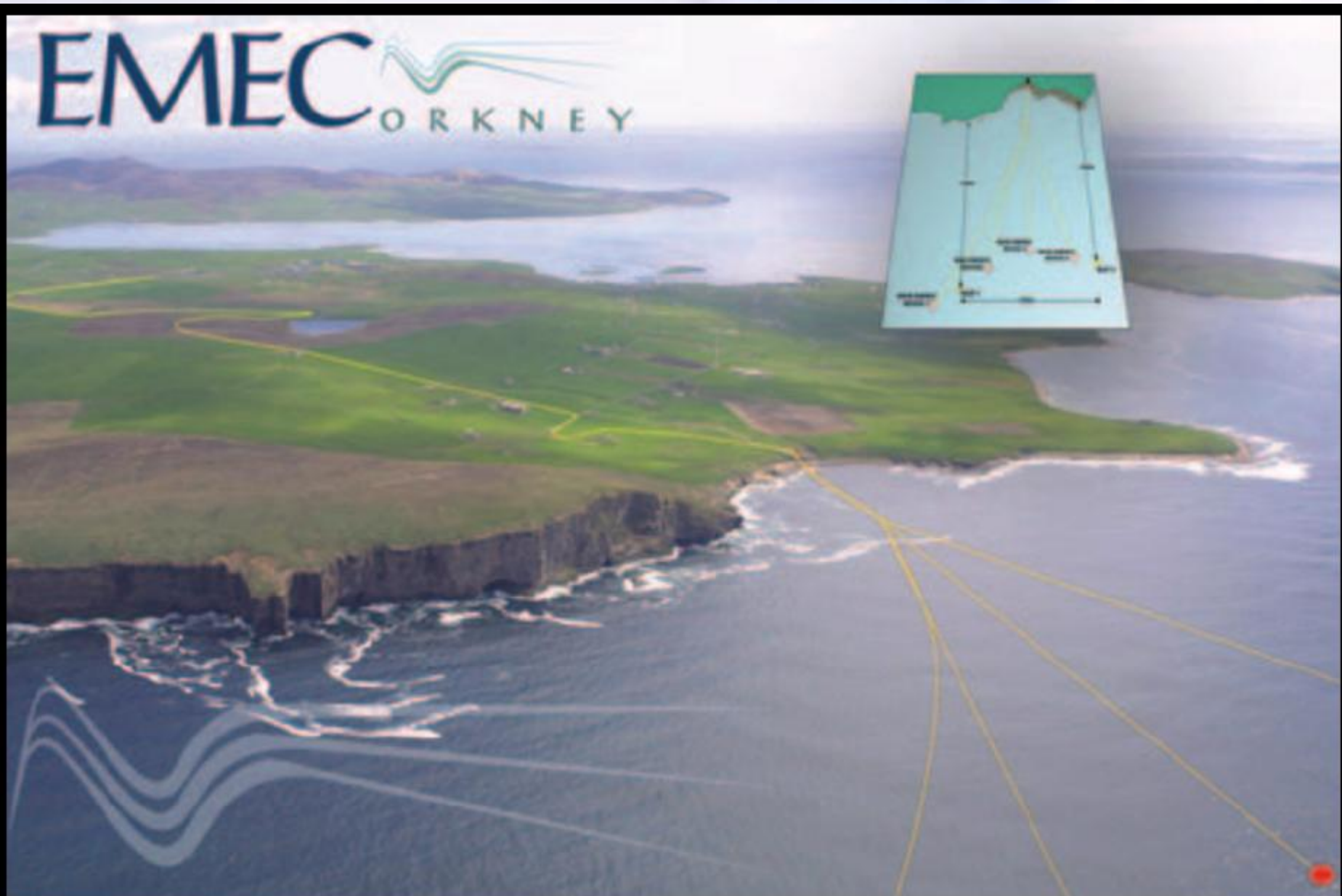


Open Hydro in Gulf Stream



UEK – Ontario Hydro

UK Ocean Energy Program Activities



Pelamis Prototype Sea Trials UK

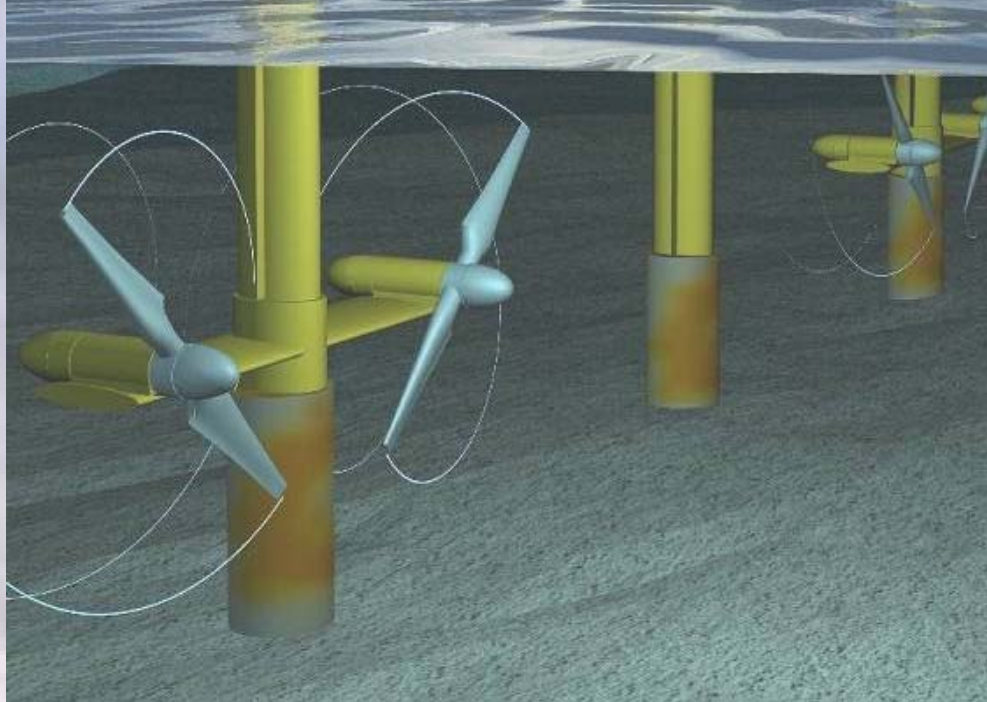


Marine Current Turbines, Ltd. – Pilot Project

<http://www.marineturbines.com>



300 kW pilot turbine
installed summer of
2003, off Cornwall in
the English Channel



Ocean Energy: Why?

- **Embryonic Technology shows promise to be cost competitive with sufficient R&D support**
- **US Companies developing new concepts under private funding**
- **International and domestic interests mounting:**
 - UK has extensive public program
 - Created European Marine Energy Center, Orkney Island
- **Consistent with U.S. National Energy Policy**
 - Seek out cost effective, clean, domestic energy sources
- **Diversifying domestic energy resources**
- **Increasing national security, energy independence**